NON-PUBLIC?: N
ACCESSION #: 9010020046
LICENSEE EVENT REPORT (LER)

FACILITY NAME: Nine Mile Point Unit 1 PAGE: 1 OF 4

DOCKET NUMBER: 05000220

TITLE: Turbine Trip/Manual Scram Due To Turbine Vibration During Torsional Test
EVENT DATE: 08/19/90 LER #: 90-020-00 REPORT DATE: 09/18/90

OTHER FACILITIES INVOLVED: DOCKET NO: 05000

OPERATING MODE: N POWER LEVEL: 21

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION:
50.73(a)(2)(iv).

LICENSEE CONTACT FOR THIS LER:
NAME: Douglas Helms, Supervisor System Support and Testing

TELEPHONE: (315) 349-2802

COMPONENT FAILURE DESCRIPTION:
CAUSE: SYSTEM: COMPONENT: MANUFACTURER:
REPORTABLE NPRDS:

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

On August 19, 1990, with the reactor mode switch in the run position, reactor power at approximately 21.5 percent, Nine Mile Point Unit 1 (NMP1) experienced turbine vibration problems when conducting Power Ascension Procedure N1-PAT-12-1, "Main Turbine-Generator Rotor System Torsional Screening Test". The turbine was manually tripped, subsequently a manual reactor scram was inserted prior to breaking vacuum to preclude an automatic reactor scram on low condenser vacuum. Consequently, a High Pressure Coolant Injection (HPCI) (mode of Feedwater control) signal was received due to low reactor water level (53 inches) and a main steam isolation valve isolation occurred on decreasing condenser vacuum (7 inches mercury Hg).

A root cause investigation determined that the most likely cause of the

Low Pressure (L.P.) turbine rotor vibration was that a slow acceleration rate through an L.P. turbine critical speed range led to the L.P. turbine rotor developing an interstage packing rub and bowed rotor.

Immediate corrective action was to terminate N1-PAT-12-1. Additionally, revision to the turbine torsional test is being pursued by Engineering and General Electric to address the technical problems encountered during the initial run.

END OF ABSTRACT

I. DESCRIPTION OF EVENT

On August 19, 1990, with the reactor mode switch in the run position, reactor power at approximately 21.5 percent, Nine Mile Point Unit 1 (NMP1) experienced turbine vibration problems when conducting Power Ascension Procedure N1-PAT-12-1, "Main Turbine-Generator Rotor System Torsional screening Test". The turbine was manually tripped, subsequently a manual reactor scram was inserted prior to breaking vacuum to preclude an automatic reactor scram on low condenser vacuum. Consequently, a High Pressure Coolant Injection (HPCI) (mode of Feedwater control) signal was received due to low reactor water level (53 inches) and a main steam isolation valve isolation occurred on decreasing condenser vacuum (7 inches mercury Hg).

The turbine generator was isolated from the electrical grid per Power Ascension Procedure N1-PAT-12-1, "Main Turbine-Generator Rotor System Torsional screening Test". This test procedure was being performed in response to a General Electric technical information letter. The purpose of this test procedure is to determine the precise location of the turbine-generator rotor system torsional resonant frequencies to ensure adequate separation between possible resonant frequencies occurring near 120 Hz and dynamic torques also occurring at 120 Hz to prevent excessive torsional response of the rotor system. This is performed by shorting one phase of the main generator to ground, applying small levels of excitation from a remote location and accelerating the unit at approximately 7 revolutions per minute (RPM) from 100 RPM up to the overspeed trip range (approximately 1945 RPM). Normal startup acceleration rates are in the range of 100 to 200 RPM per minute. Low Pressure (L.P.) turbine critical speed is 1050 RPM to 1200 RPM. During the slow acceleration ramp, momentary high vibration level was noted in the L.P. "A" rotor at its critical speed, however it cleared and returned to normal within the time span of the computer printout readout (once per minute). The main turbine generator was manually tripped at

approximately 18:31 due to a high level of vibration in the Low Pressure "A" rotor. Turbine speed at this time was approximately 1910 RPM and the vibration level was 10 mils. Immediately after the turbine trip vibration levels returned to normal values. The high vibration level was a result of an interstage packing rub and bowed rotor that developed during the modified acceleration ramp rate of 7 RPM and the momentary vibration peak at the critical speed
The intent of the turbine trip,
without breaking vacuum, was to allow the turbine to coast down to 0 RPM and be placed on the turning gear to allow the rotor bow to roll out. At approximately 18:46, during the coastdown, the L.P. "A" rotor reentered its critical speed range. Due to the previously induced rotor bow and the response of the rotor to its resonant speed, an interstage packing rub was produced. This resulted in increasing vibration levels of the L.P. "A" rotor associated bearings exceeding the 15 mil computer readout range, within a time span of approximately 30 seconds (5 mils to 15+ mils) .

The reactor was manually scrammed at this time in order to break vacuum and slow the rotor speed below its critical range as soon as possible before damage was done to the unit. Normal coastdown time of the turbine without breaking vacuum in the main condenser would have allowed the level of vibration to be maintained for several minutes. The manual reactor scram was inserted at 18:46:38 hours, the vacuum breakers were opened approximately 30 seconds later.

Reactor water level rapidly dropped after the scram to 48 inches due to void collapse and the resulting shrinkage, with HPCI initiating and a second scram signal being generated due to low reactor water level (at 53 inches). These are expected occurrences during this type of transient. Water level was restored, HPCI was reset and eventually #12 motor-driven Feedwater pump was secured to control the water level increase.

As condenser vacuum decreased, all expected alarms came in and eventually the Main Steam Isolation Valves isolated on low-low condenser vacuum (7 inches). Reactor pressure and temperature decreased slowly due to lack of decay heat.

A 4 hour non-emergency telephone notification was made to the NRC at 20:00 in accordance with 10CFR50.72(b)(2)(ii). The reactor scram was reset at approximately 19:38.

II. CAUSE OF EVENT

A formal root cause investigation determined the most likely cause of the Low Pressure (L.P.) turbine rotor vibration was that a slow acceleration rate through an L.P. turbine critical speed range led to the L.P. turbine rotor developing an interstage packing rub and bowed rotor.

III. ANALYSIS OF EVENT

This event is reportable in accordance with 10CFR50.73(a)(2)(iv): "Any event or condition that results in manual or automatic actuation of any Engineered Safety Feature (ESF), including the Reactor Protection System (RPS). However, actuation of an ESF, including RPS, that results from and was part of the preplanned sequence during testing or reactor operation need not be reported". The manual reactor scram was inserted prior to breaking vacuum to preclude an auto scram on decreasing main condenser vacuum at 23 inches Hg. Consequently, the MSIV's auto closed at 7 inches vacuum and an auto scram occurred on low level of 53 inches of water with a HPCI initiation.

There were no significant safety consequences as a result of this event nor was the reactor in an unsafe condition at any time. The initiation of HPCI is a protective mode of operation and thus performed its intended safety function. The plant was then stabilized and the auto scram was reset. Therefore, the health and safety of plant personnel and the general public was not affected.

IV. CORRECTIVE ACTIONS

Immediate corrective actions consisted of:

A. Tripping the turbine.

B. Manually inserting a reactor scram.

C. Breaking vacuum in the condenser to slow the turbine as soon as possible

Additional corrective action will be to revise N1-PAT-12-1 to preclude turbine operation at test acceleration rates, at or near L.P. turbine critical speeds, therefore preventing interstage packing rub and bowed rotor.

V. ADDITIONAL INFORMATION

A. Previous similar events: LER 90-17 reported a similar event in that

a manual reactor scram was inserted and condenser vacuum broken to quickly reduce turbine speed due to vibration. However, the two events are not related, LER 90-17 vibrations were due to bearing failure.

B. Components referred to in this Licensee Event Report:

IEEE 803 IEEE 805
COMPONENT FUNCTION SYSTEM

High Pressure Coolant Injection NA BJ
Turbine Generator TG TA
Main Steam Isolation Valve ISV SB
Feedwater Controllers FC SJ
Manual Scram NA AA
Rotor Bearing NA TD

C. Failed components: None.

ATTACHMENT 1 TO 90010020046 PAGE 1 OF 1

NIAGARA
MOHAWK

NINE MILE POINT NUCLEAR STATION/P.O.BOX 32,LYCOMING,N.Y. 13093/TELEPHONE (315) 343-2110

NMP70199

September 18, 1990

United States Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

RE: Docket No. 50-220
LER 90-20

Gentlemen:

In accordance with 10 CFR 50.73, we hereby submit the following Licensee Event Report.

LER 90-20 Which is being submitted in accordance with 10 CFR 50.73 (a) (2) (iv), "Any event or condition that resulted in manual or automatic actuation of any Engineered Safety

Feature (ESF), including the Reactor Protection System (RPS). However, actuation of an ESF, including the RPS, that resulted from and was part of the preplanned sequence during testing or reactor operation need not be reported".

A 10 CFR 50.72 report was made at 2000 hours on August 19, 1990.

This report was completed in the format designated in NUREG-1022, Supplement 2, dated September 1985.

Very truly yours,

Joseph F. Firlit
Vice President - Nuclear Generation
JFF/DPS/lmc

ATTACHMENT

cc: Thomas T. Martin, Regional Administrator, Region I
W. A. Cook, Sr. Resident Inspector

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